Better Buildings Residential Network Peer Exchange Call Series:

Looking Ahead in 2019: Hear About Trends in the Field

January 10, 2018

Agenda and Ground Rules

- Agenda Review and Ground Rules
- Opening Poll
- Residential Network Overview and Upcoming Call Schedule
- Featured Speakers:
  - **Frank Rapley & Beth Parsons**, Tennessee Valley Authority (TVA)
  - **Peter Troast**, Energy Circle
  - **Martha Campbell,** Rocky Mountain Institute (RMI)
- Open Discussion
- Closing Poll and Announcements

Ground Rules:

1. **Sales of services and commercial messages are not appropriate** during Peer Exchange Calls.
2. Calls are a safe place for discussion; **please do not attribute information to individuals** on the call.

The views expressed by speakers are their own, and do not reflect those of the Dept. of Energy.

Better Buildings Residential Network

Join the Network

Member Benefits:

- Recognition in media and publications
- Speaking opportunities
- Updates on latest trends
- Voluntary member initiatives
- Solution Center guided tours

Commitment:

- Members only need to provide *one number*: their organization's number of residential energy upgrades per year, or equivalent.

Upcoming calls:

- January 24th: Resiliency in the Face of Disaster: Energy Efficiency's Role
- February 14th: We Love Our National Labs: Research Results (Part 1)
- February 28th: We Love Our National Labs: Research Results (Part 2)

Peer Exchange Call summaries are posted on the Better Buildings website a few weeks after the call

For more information or to join, for no cost, email bbresidentialnetwork@ee.doe.gov, or go to energy.gov/eere/bbrn & click Join

Frank Rapley & Beth Parsons
Tennessee Valley Authority

U.S. DEPARTMENT OF
ENERGY

Health and Household Benefits Attributable to the Knoxville Extreme Energy Makeover (KEEM) Project: Preliminary Final Results

FRANK RAPLEY
BETH PARSONS
JANUARY 2019

Presentation prepared by Bruce Tonn at Three^3, Inc.

Acknowledgements

- This research is made possible by a grant from the Robert Wood Johnson Foundation.
- This project benefits from an extraordinary set of partners:
  - Tennessee Valley Authority (TVA)
  - Office of Sustainability, City of Knoxville
  - City of Knoxville-Knox County Community Action Committee (CAC)
  - Knoxville Utilities Board (KUB)
  - Center for Applied Research and Evaluation (CARE), University of Tennessee, Knoxville

Outline

- About KEEM
- Research Design
- Selected Preliminary Final Results
  - Demographics
  - Home Conditions
  - Health Impacts
  - Budget Tradeoffs
- Research Next Steps

Tennessee Valley Authority's Extreme Energy Makeovers

- TVA-funded initiative to address energy affordability needs of limited-income families in seven communities
- Targeted 25% electric energy savings at no cost to participants
- Homes ≥ 20 years old
- Maximum spend of $10.00 per square foot
- Community and participant education and outreach required

Knoxville Extreme Energy Makeover

CAC Knoxville - Knox County Community Action Committee
Helping People. Changing Lives.

CITY OF KNOXVILLE

KUB

ALLIANCE TO SAVE ENERGY
Creating an Energy-Efficient World

Research Design

- Spring and summer (2017), a phone survey was administered to three groups of homes:
  - CwT – Comparison with Treatment Group (i.e., already received weatherization)
  - T – Treatment Group (i.e., will receive weatherization during course of study)
  - CWL – Control Waiting List Group (i.e., will not be weatherized during course of study)
- The survey collected data on reported health conditions, home conditions, budget issues and demographics.
- The survey was re-administered fall(2018). Door-to-door non-response follow-up is now being conducted.

Demographics – Collected Pre-Treatment/Post-Treatment

Variable/Group	Comparison (N=150/130)	Treatment (N=88/66)	Control (N=191/91)
Respondent Gender: Female	73.1%/74.6%	78.4%/78.8%	78.7%/78.0%
Respondent Age	58/59	55/56	56/60
Average Household Size	2.03/2.06	2.03/2.08	2.17/2.01
Black or African American	44.7%/46.2%	33.0%/37.9%	26.7%/25.3%
Respondent Employed	35.0%/31.5%	39.8%/34.8%	37.4%/35.7%
Respondent Retired	30.5%/32.3%	22.7%/21.2%	25.3%/34.1%
Respondent Married	19.8%/17.7%	22.7%/22.7%	26.7%/28.6%
Respondent Education: GED or less	50.2%/50.0%	43.1%/37.9%	58.0%/56.1%

Home Sometimes Kept at Unhealthy Temperature

	Comparison Group	Treatment Group	Control Group
Pre-weatherization	12.7%	51.2%	42.6%
Post-weatherization	11.6%	15.2%	28.6%
Change	-1.1%	-36.0%	-14.0%

Home Was Observed To Be Drafty

	Compariso n Group	Treatment Group	Control Group
Pre-weatherization	12.2%	45.4%	34.7%
Post-weatherization	10.0%	15.2%	24.2%
Change	-2.2%	-30.2%	-10.5%

Number of Days Previous Month Mental Health Not Good: Main Respondents

	Comparison Group	Treatment Group	Control Group
Pre-weatherization	4.8	9.7	8.0
Post-weatherization	6.0	6.4	8.3
Change	+1.2	-3.3	+.3

Number of Days Previous Month Rest/Sleep Not Good: Main Respondents

	Comparison Group	Treatment Group	Control Group
Pre-weatherization	9.7	15.3	13.7
Post-weatherization	11.6	12.1	11.7
Change	+1.9	-3.2	-2.0

It is Hard to Pay Energy Bills

	Comparison Group	Treatment Group	Control Group
Pre-weatherization	50.8%	76.1%	65.4%
Post-weatherization	57.7%	51.3%	52.8%
Change	+6.9%	-24.8%	-12.6%

Did Not Buy Food to Pay Energy Bills

	Compariso n Group	Treatment Group	Control Group
Pre-weatherization	27.4%	35.2%	46.1%
Post-weatherization	30.8%	28.8%	39.6%
Change	+3.4%	-6.4%	-6.5%

Missed Days of Work: Primary Wage Earner

	Comparison Group	Treatment Group	Control Group
Pre-weatherization	12.7	16.8	17.8
Post-weatherization	7.1	7.5	17.0
Change	-5.6	-9.3	-0.8

How Often Receive a Disconnect Notice

	Compariso n Group	Treatment Group	Control Group
Pre-weatherization	36.7%	51.1%	59.4%
Post-weatherization	29.9%	39.4%	42.7%
Change	-9.8%	-12.7%	-16.7%

Research Next Steps

- Complete re-survey of KEEM households.
- Acquire energy savings estimates for CwT and T based on the analysis of weather normalized utility bills.
- Estimate changes of health attributable to KEEM.
- Monetize a subset of these benefits (e.g., asthma).
- Conduct explanatory factors analysis to attribute changes in health attributable to specific and/or packages of weatherization measures.
- Explore health benefits deriving from direct and indirect changes in household budgets from energy cost savings.

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TVA

Key Points

- TVA-funded pilot initiative targeted 25% energy savings in residential retrofits with maximum spend of $10/sq. ft.
- Follow-up surveys indicated promising results
- Next steps include further research into energy savings and an exploration/quantification of health benefits of retrofits

Peter Troast
Energy Circle

U.S. DEPARTMENT OF ENERGY

Residential Energy Efficiency—Looking Ahead 2019

Peter Troast, Energy Circle

DOE Better Buildings Residential Network

Peer Exchange Call, January 10, 2019

The Lens I See Through

Marketing & Lead Generation Services for 350+ Better Building Contracting Businesses

HVAC, Home Performance, Solar, Insulation, Auditors/Raters, Builders, Remodelers

50 States, Canada & Countless Climate Zones

An Inside View of Many Business Models and Their Success

Deep Dataset on What is Making the Phone Ring

Our Mantra: More Successful Contractors = More Retrofits

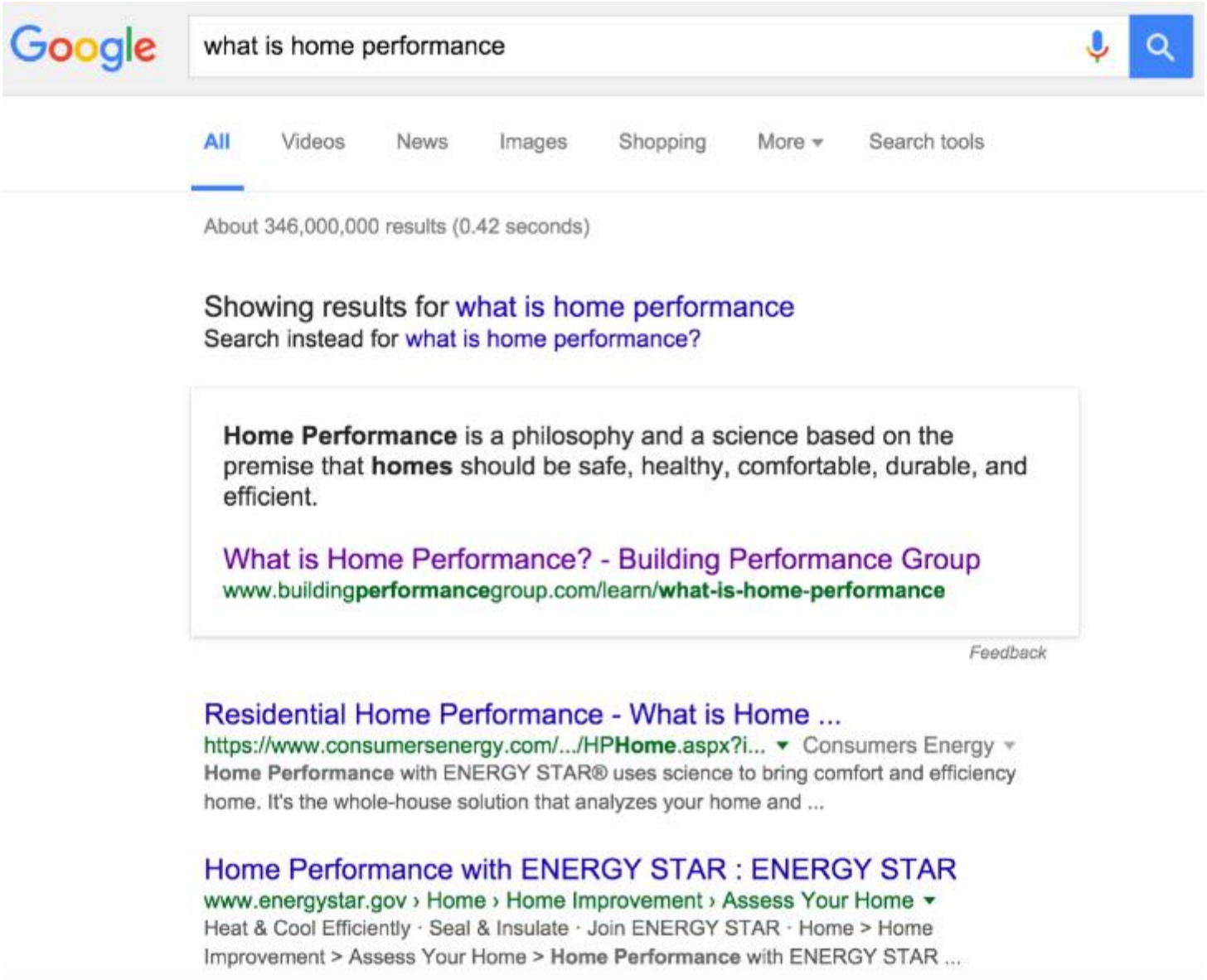
Thoughts As We Enter 2019

1. DIVERSIFYING BUSINESS MODELS = HOME PERFORMANCE SUCCESS
2. SERVICES THAT ARE BREAKING THROUGH & PROVIDING “GATEWAYS” TO LARGER JOBS

DIVERSIFYING BUSINESS MODELS

=

HOME PERFORMANCE SUCCESS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Showing results for what is home performance
Search instead for what is home performance?
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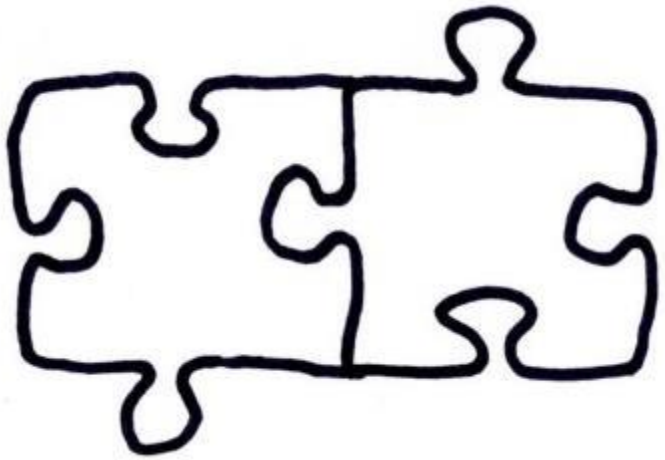
HOME PERFORMANCE

Envelope



Mechanicals

+

Testing

energy circle

Residential Retrofit Business Models

Envelope (Shell or WX)

- Insulation Contractor
  - Spray Foam Contractor
  - Cellulose Installer
  - New Construction Insulator
  - Mixed New & Retrofit Insulator
- Air Sealing Specialist
- Weatherization
- Crawl Space Repair
- Basement Waterproofing

Mechanical

- Traditional Heat and Cool
- Geothermal
- Heat Pump Specialists
- Plumber/Furnace
- Ventilation

Other & Related

- Solar
- Mold Remediation
- Healthy Home
- Handyman
- Connected Home (Home Automation)

Consultant/Technician

- Energy Auditor
  - Pure Auditor
  - Auditor/Recommender
  - Auditor/Construction Manager
  - Network
  - Auditor/Inspector
- Rater
  - Production Home Rater
  - Solo Rater
  - Passive House Rater
- Certified Passive House Consultant
- LEED Rater
- Indoor Air Quality Tech

Where I'm Seeing Growth

Envelope (Shell or WX)

- Insulation Contractor
  - Spray Foam Contractor
  - Cellulose Installer
  - New Construction Insulator
  - Mixed New & Retrofit Insulator
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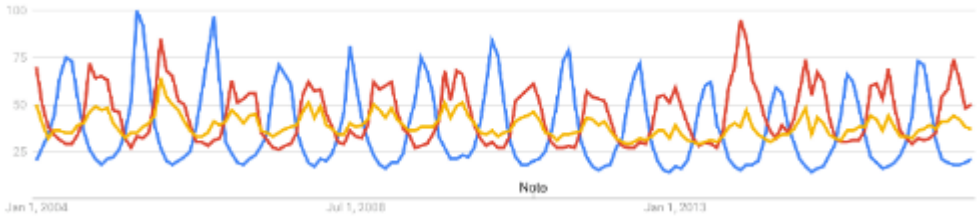
- Indoor Air Quality Tech

Commonalities of Thriving Contractors

Service Diversity

- Seasonal Balance
- Emerging Categories



Recurring Revenue

- Service Contracts
- Staged Retrofit Plans

Strong Brands

- Homeowner Preference
- In the Real World & Online
- Third Party Reviews

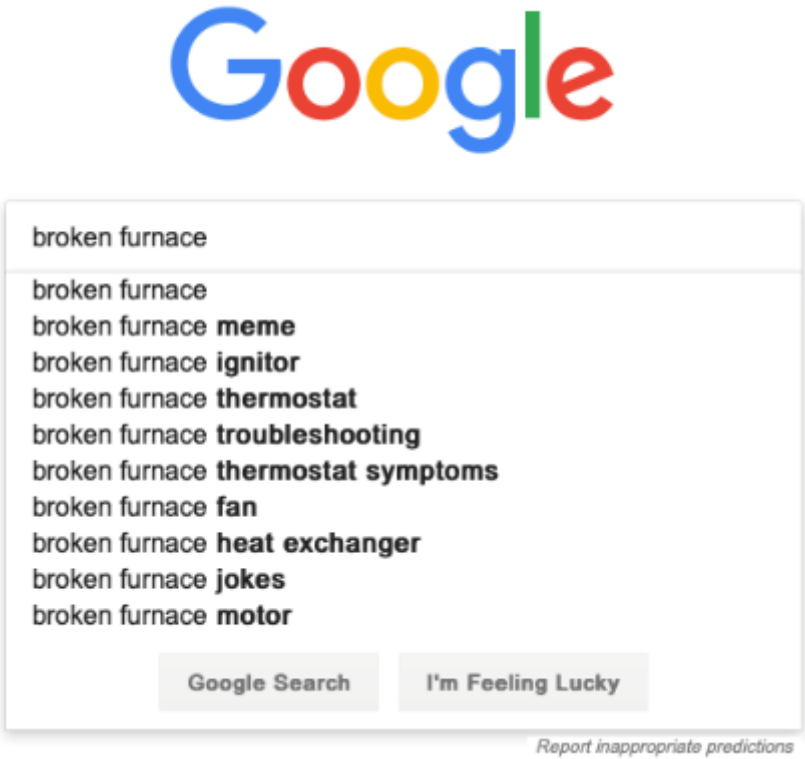
Quality Operations

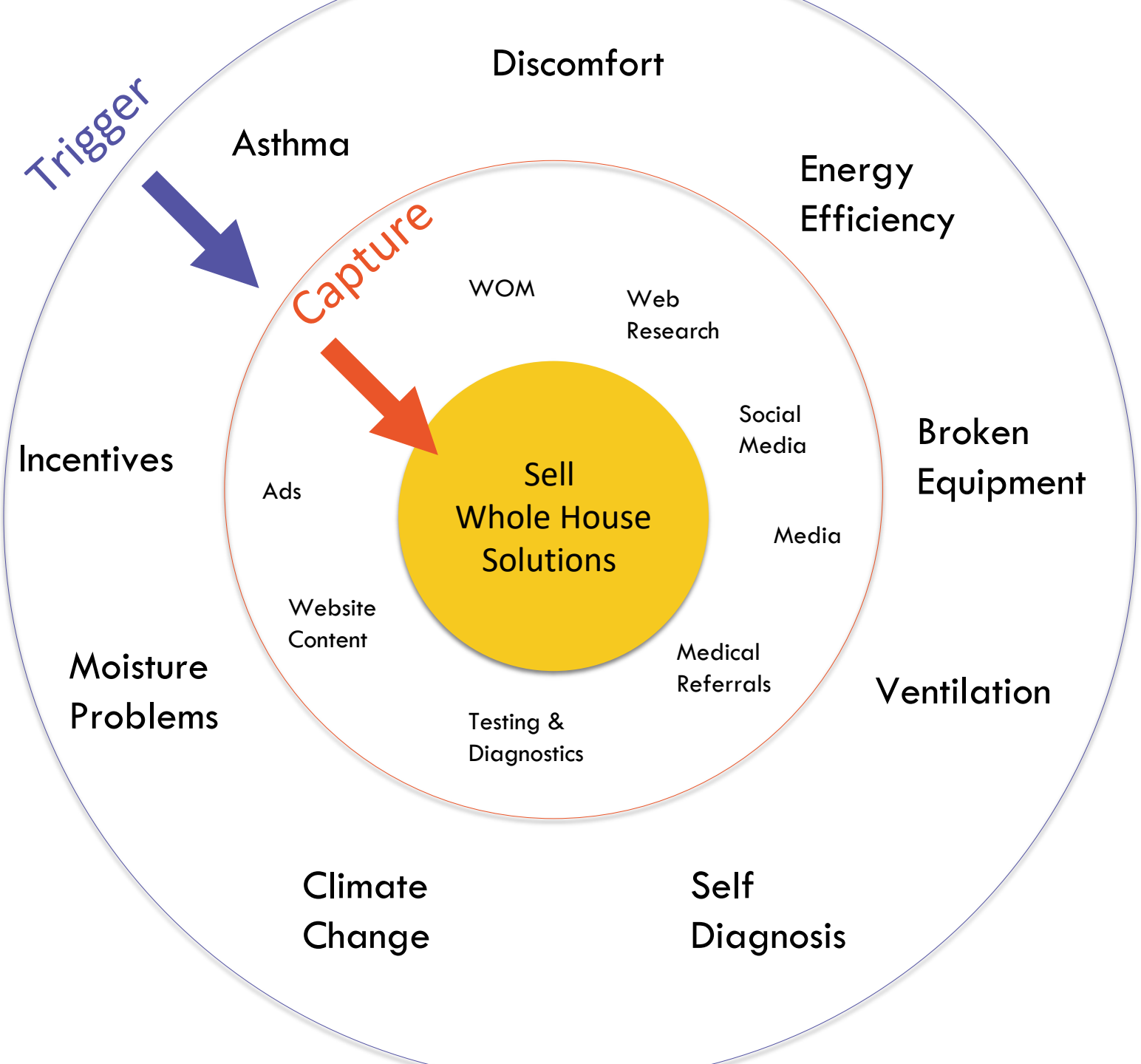
- First Touch to Last Touch

SERVICES THAT ARE BREAKING THROUGH & PROVIDING "GATEWAYS" TO LARGER JOBS

“Gateway” Concept

the Home Performance journey begins with a single measure lead




Discomfort
Trigger
Asthma
Energy Efficiency
Capture
WOM
Web Research
Social Media
Incentives
Broken Equipment
Ads
Sell Whole House Solutions
Media
Website Content
Medical Referrals
Moisture Problems
Ventilation
Testing & Diagnostics
Climate Change
Self Diagnosis

Gateway Concept

Homeowner concerns start with a *single trigger*. Successful contractors *pivot the homeowner mindset* to system thinking & high impact, whole house jobs.

Good Gateways, Challenging Ones

initial triggers that are more easily converted to comprehensive jobs

Good	Improving?	Difficult
Crawlspace Repair	Healthy Home	Windows
Discomfort	IAQ	Solar
Home Electrification	Mini-Splits (Ductless)	HVAC Repair
Net Zero	Smart Home	
Spray Foam	HVAC Service	

Data Sources:
Search Volume (proxy for interest level)
Website Conversion Rates (Visit to Lead)
Customer Acquisition Cost (Client Provided)
Average Job Size (Client Provided)

QUESTIONS?

Peter Troast

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207.847.3644

Key Points

- Commonalities among thriving contractors include service diversity, recurring revenue streams, strong brands and quality operations

- Gateway concept: homeowner concerns start with a single “trigger;” successful contractors pivot the homeowner mindset to system thinking & high-impact, whole-house jobs

- Good triggers: crawlspace repair, discomfort, home electrification, net zero and spray foam

Martha Campbell
Rocky Mountain Institute

U.S. DEPARTMENT OF ENERGY


REALIZE
ROCKY MOUNTAIN INSTITUTE
Transforming global energy use to create a clean, prosperous, and secure low-carbon future.

AGENDA

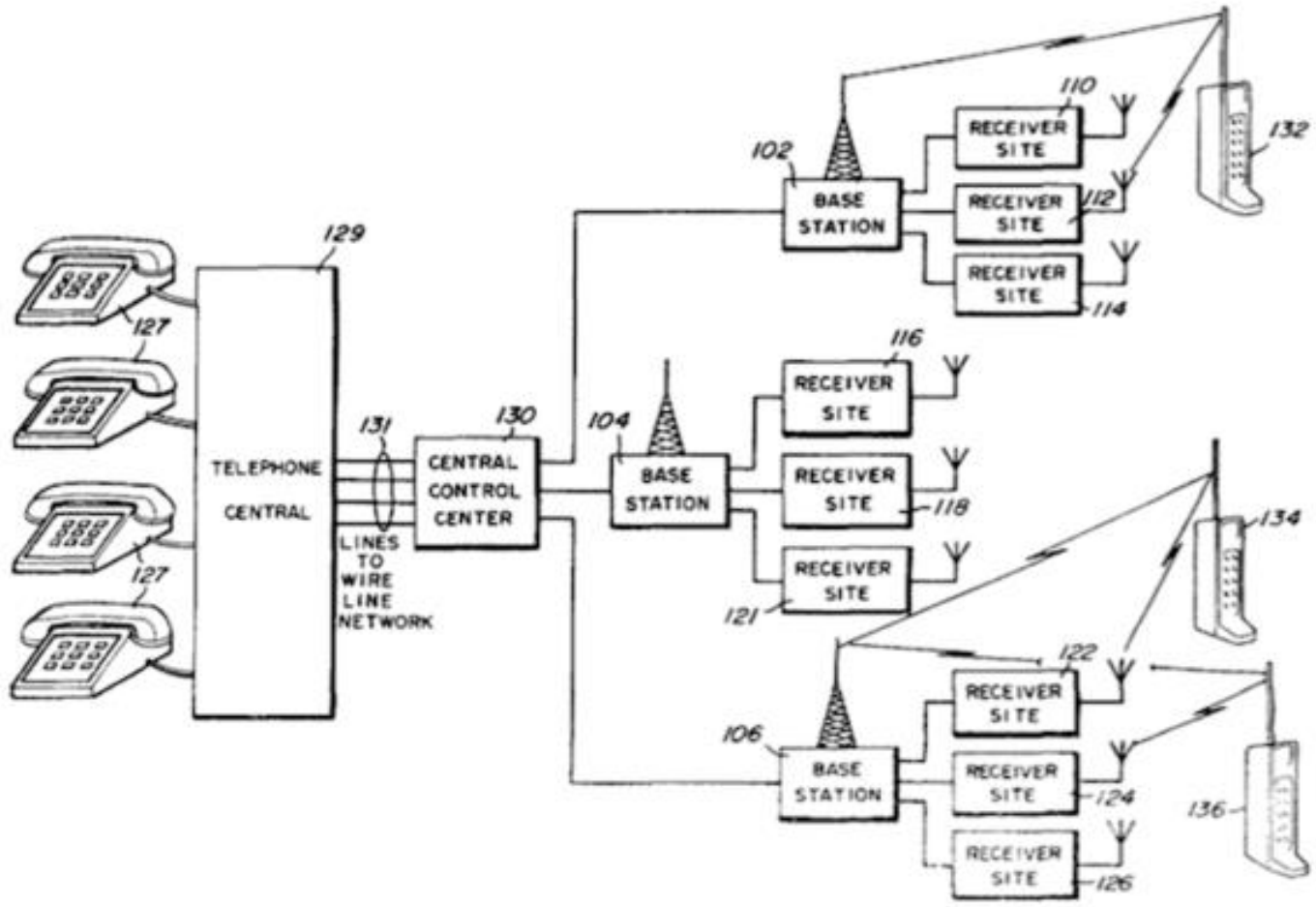
- REALIZE OVERVIEW
- NETHERLANDS FIELD TRIP
  - ENVELOPE SYSTEMS
  - MECHANICAL SYSTEMS

AGENDA

- REALIZE OVERVIEW
- NETHERLANDS FIELD TRIP
  - ENVELOPE SYSTEMS
  - MECHANICAL SYSTEMS

THE PROBLEM

A SERVICE ANALOGY



THE SOLUTION

ENERGIESPRONG: A MODEL OF INSPIRATION

Core offering: A net zero carbon retrofit bundle that is 1) affordable, 2) attractive, 3) ensures energy performance, and 4) can be delivered in less than two weeks

QUALITY

Net-zero energy homes with long performance warranties

NON-INTRUSIVE

Refurbishment within a week to 10 days

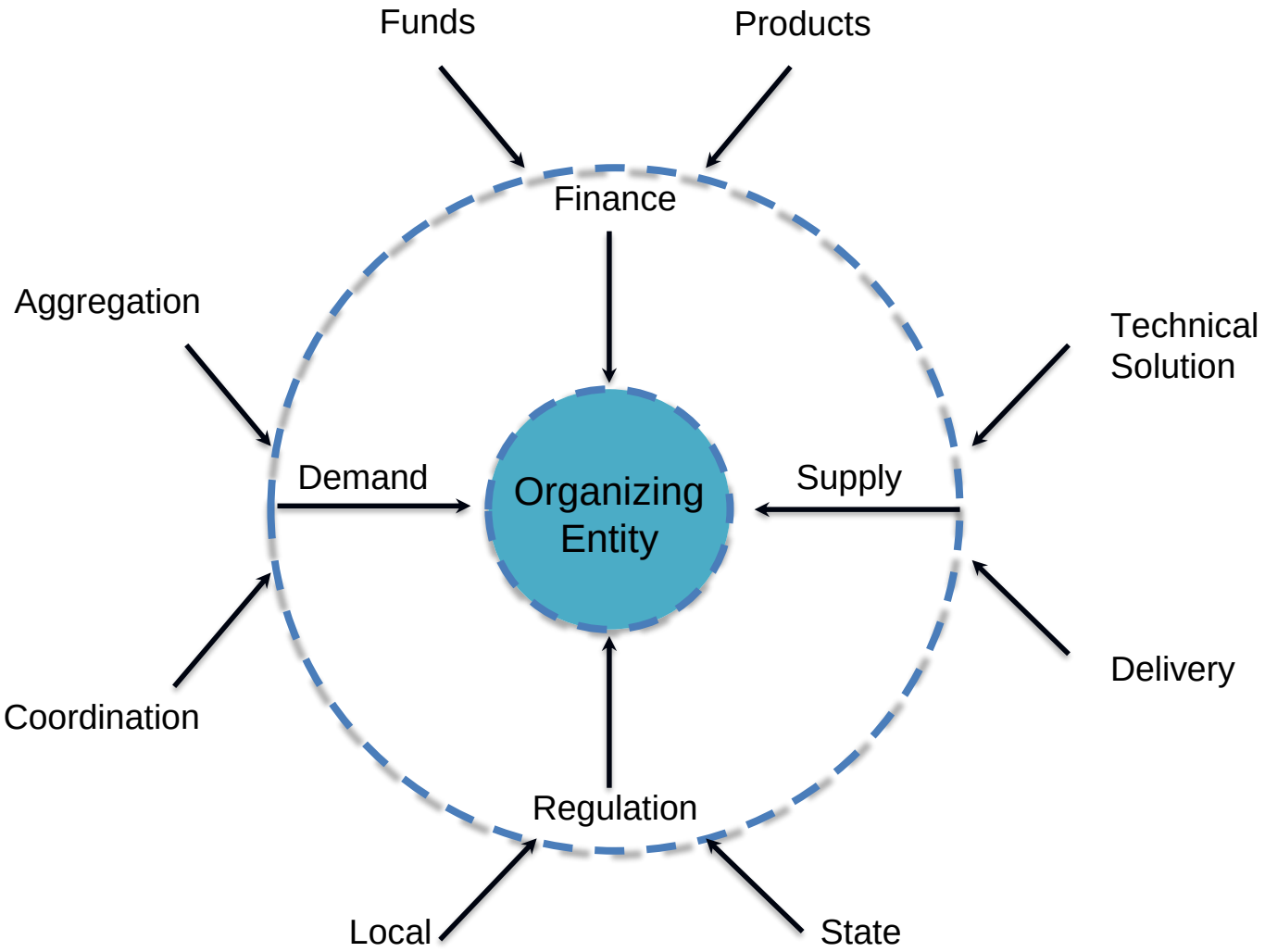
AFFORDABLE

Financeable through energy cost savings

LOOK & FEEL

Attractive and comfortable homes

MARKET ENABLEMENT MODEL



REALIZE: GOAL AND MISSION

REALIZE seeks to create a business model inspired by Energiesprong to catalyze industry to develop readily available, cost-effective, deep energy retrofits for the US residential market

SOME OF OUR PARTNERS

U.S. DEPARTMENT OF ENERGY

CNCA
CARBON NEUTRAL CITIES ALLIANCE

PHIUS
Passive House Institute US

Net-Zero
ENERGY COALITION

SEA
stone energy associates

NEW ECOLOGY
Community-Based Sustainable Development

CALIFORNIA ENERGY COMMISSION

Energie Sprong

ELEVATE ENERGY
Smarter energy use for all

nyserda
Energy. Innovation. Solutions.

PROSPECT
Silicon Valley

RenewAire
Energy Recovery Ventilation

THE LEVY PARTNERSHIP

Natural Resources Canada

INTEGRAL GROUP

AGENDA

- REALIZE OVERVIEW
- NETHERLANDS FIELD TRIP
  - ENVELOPE SYSTEMS
  - MECHANICAL SYSTEMS

ENVELOPE SYSTEMS

FACADE PANELS: A VARIETY OF SOLUTIONS

THE KEY PLAYERS

- There are three main facade panel manufacturers in the Netherlands:
  - RC Panels - SIPs
  - Renolution - light gauge steel
  - Dijkstra Draaisma Bouwgroep (DDB) - timber framed

- RMI visited RC Panels' production facility and several project sites with RC Panels or Renolution products

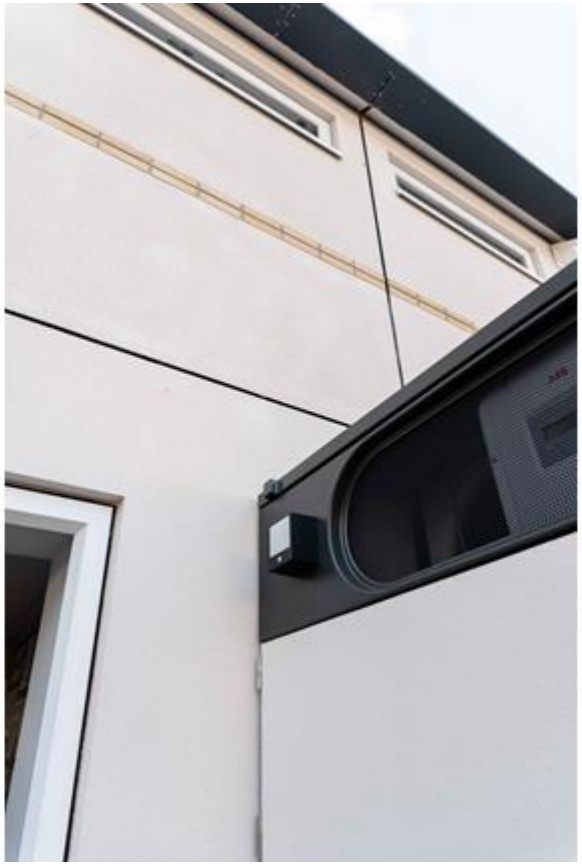
RC PANELS FACTORY PRODUCTION

Panel Description:

- SIP panels made with fiberglass, OSB, graphite-infused foam, and waterproofing sealant material.
- Cut to meet 3D imaging model specifications by CNC machine
- Windows and doors installed into panel
- Exterior claddings applied to panel: stucco and STO brick veneer

FACADE INSTALLATION SITE PRE-WORK

PANEL JUNCTION DETAILS



RENOLUTION PROJECT

KEY LESSONS LEARNED FOR US PILOTS

- Design something that is scalable by focusing on unitized panels that can be mass customized
- Our building science will be better, but there could be something to learn from the Dutch approach of not letting the perfect get in the way of the good
- Foster development of multiple solution types
- Site pre-work and tenant engagement are key to success
  - Total delivery time was between 4-8 months, including site prep and kitchen/bathroom retrofit
  - Need to inform tenants of plans

AGENDA

- REALIZE OVERVIEW
- NETHERLANDS FIELD TRIP
  - ENVELOPE SYSTEMS
  - MECHANICAL SYSTEMS

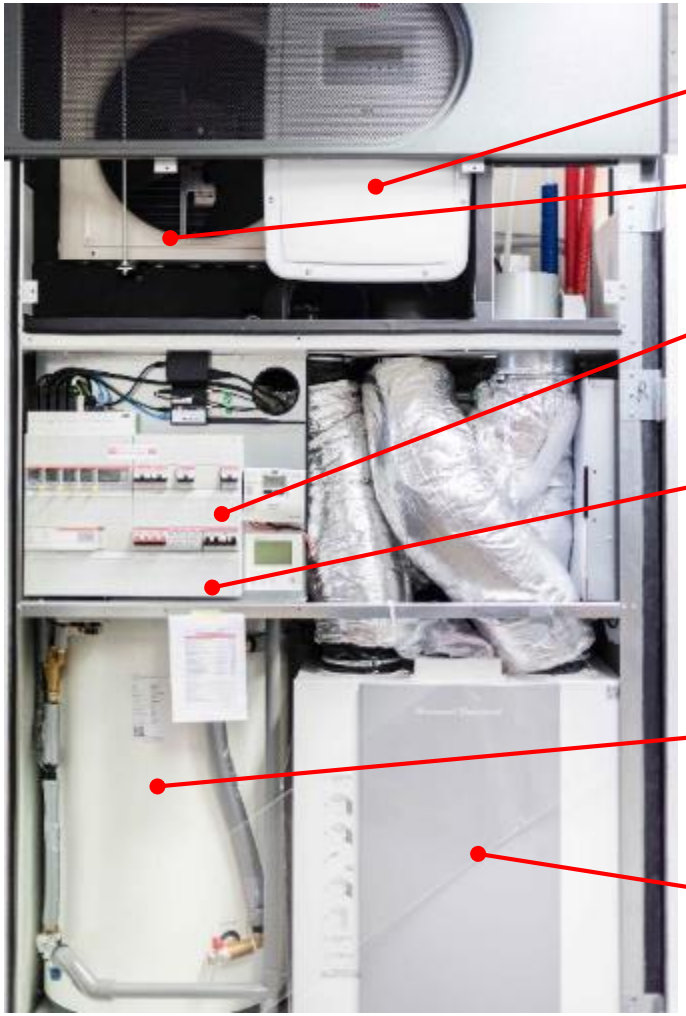
ENERGIESPRONG MECHANICAL SYSTEMS

- Energiesprong retrofits are always all-electric
- The mechanical systems typically consists of a heat pump (space heating and DHW), ERV, hot water tank, solar panels, PV inverter, printed circuit board controls, an induction cooktop, and new bathroom fixtures
- In some projects, the heat pump, HPWH, ERV, PV inverter, and control board were distributed, while in others they were packaged together in one unit or one mechanical closet
  - later project iterations utilize a packaged mechanical system box, as developed by Factory Zero
- The market was late to innovate on the mechanical side and more progress has been made on the facade systems

DISTRIBUTED MECHANICAL SYSTEM EXAMPLE

- Mitsubishi HP for space heating in exterior cabinet
- Interior HPWH and tank
- Zehnder ERV

FACTORY ZERO INTEGRATED CLIMATE ENERGY MODULE (iCEM)



- Parts sourced from various OEMs and assembled on site
- Approximately 8 units assembled per week
- Working with Denzo to get standardized parts for next model

FACTORY ZERO PROJECT EXAMPLES

INTERIOR DETAILS

KEY LESSONS LEARNED FOR US PILOTS

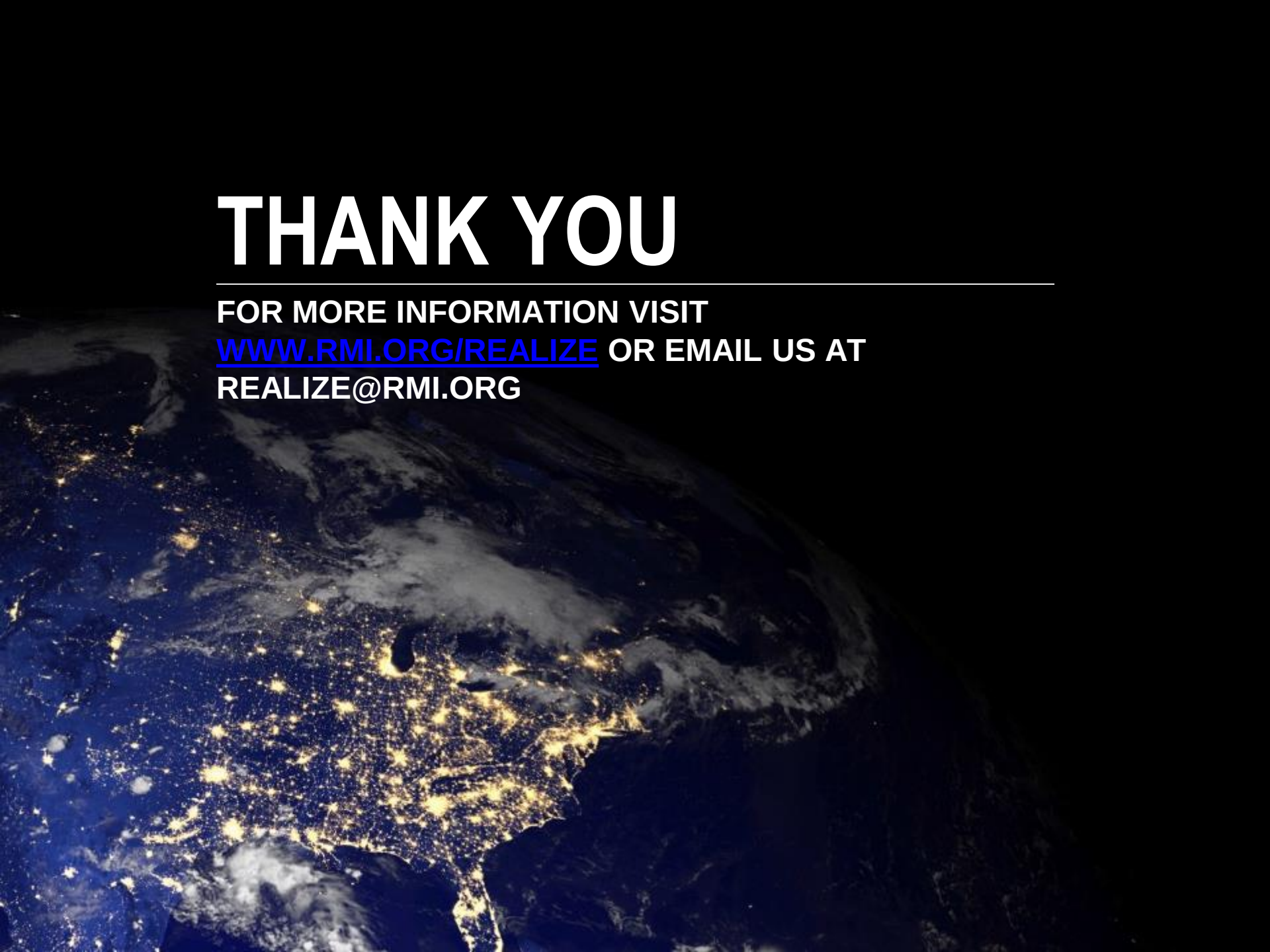
- The mechanical manufacturer market could be harder to move than the facade panel market - encourage the use of integrated, packaged systems early on

- The US market will need to figure out how to incorporate cooling and dehumidification into system design (depending on the climate)

- Multiple system type options should be developed for various climates

THANK YOU

FOR MORE INFORMATION VISIT WWW.RMI.ORG/REALIZE OR EMAIL US AT REALIZE@RMI.ORG



Key Points

- The Energiesprong model: a net-zero carbon retrofit bundle that is affordable, attractive, ensures energy performance and can be delivered in less than two weeks

- Key lessons from RMI's REALIZE project in the US:
  - Encourage use of integrated packaged systems early on
  - Figure out how to incorporate cooling and dehumidification into system design
  - Multiple system type options should be developed for different climates

Explore the Residential Program Solution Center

Resources to help improve your program and reach energy efficiency targets:

- Handbooks - explain *why* and *how* to implement specific stages of a program.
- Quick Answers - provide answers and resources for common questions.
- Proven Practices posts - include lessons learned, examples, and helpful tips from successful programs.
- Technology Solutions NEW! - present resources on advanced technologies, **HVAC** & **Heat Pump Water Heaters**, including installation guidance, marketing strategies, & potential savings.

https://rpsc.energy.gov

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Please send any follow-up questions or future call topic ideas to:
bbresidentialnetwork@ee.doe.gov